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Validation of the Korean version of the oral health impact profile among the Korean elderly

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Abstract – *Objectives:* This study aimed to validate a Korean version of the oral health impact profile (OHIP) and to develop a short-form of OHIP for the Korean elderly. *Methods:* The original English version of OHIP was translated into Korean using a forward-backward method. Internal consistency was measured by Cronbach's alpha among 1098 subjects aged 56 or more. Test-retest reliability was assessed by intraclass correlation coefficients (ICCs) with a 3-month interval among 155 subjects aged 57 or more. The validity of the Korean version of OHIP (OHIP-K) was assessed by comparing OHIP scores with the perceived dental treatment needs and by identifying associations between OHIP scores and the number of natural teeth among 128 subjects aged 54 or more. The short-form of OHIP for the Korean elderly (OHIP-14K) was developed using linear regression models and was also validated and compared with the short-form of OHIP by Slade (OHIP-14S). *Results:* The Cronbach's alpha value for OHIP-K was 0.97. The ICC for OHIP-K was 0.64. Adults with perceived dental treatment needs had a higher OHIP score than adults without any such needs ($P < 0.001$). The number of natural teeth was negatively associated with the OHIP score ($r = -0.44$, $P < 0.001$). OHIP-14K and OHIP-14S shared seven identical items out of a total of 14 items. OHIP-14K results correlated with OHIP-K almost exactly ($r^2 = 0.96$), as did OHIP-14S ($r^2 = 0.95$). *Conclusions:* OHIP-K showed excellent reliability and validity. OHIP-14S may be a better choice for the evaluation of oral health-related quality of life among the Korean elderly for an international comparison.

Key words: elderly; Korean version; oral health impact profile; reliability; validity

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A variety of methods measuring oral health related quality of life (OHRQoL) have been developed as a result of increased awareness regarding the relationship between a person's oral health and their quality of life (1). The oral health impact profile (OHIP) is one of the most comprehensive instruments available. It is distinct from other related measurements in that it was based on an explicit conceptual framework and was derived from the accounts of dental patients with a variety of oral conditions (2). The 49 questions in OHIP capture seven conceptually formulated dimensions that are based on Locker's theoretical model of oral health (3). More than eighty articles applying OHIP have been published and it is one of the most commonly used instruments for measuring OHRQoL. OHIP is studied and used to measure OHRQoL in many countries that use English as a first language, including Australia (4, 5), the United States (5), Canada (2, 5–7), and the United Kingdom (8, 9). Translated or modified versions of OHIP have been developed in many other countries, including some French regions of Canada (6), Germany (10), China (11), Sri Lanka (12), Brazil (13), Israel (14) and Sweden (15). OHIP has been used in longitudinal studies (16) and its sensitivity to change has been demonstrated in clinical trials (17). Although OHIP is a comprehensive and useful instrument, it is a

long questionnaire with 49 items. Slade (18) derived and validated a short-form OHIP (OHIP-14S), which has been widely used in many studies (8, 19, 20). Because of the demonstrated usefulness of OHIP, Korean versions of OHIP (OHIP-K) and short-form OHIP (OHIP-14K) would be valuable to a Korean population. However, a thorough translation of OHIP into Korean would not necessarily ensure applicability across nations because of cultural diversity. Hence, these instruments need to be validated for a Korean population.

The objectives of this study were to assess the reliability and validity of OHIP-K and to develop a short-form of OHIP for the Korean elderly.

Materials and methods

Subjects

The OHIP-K and OHIP-14K were developed and validated through the following five steps: Translation – reliability – validity – application – development of OHIP-14K. Three different types of samples, who gave us verbal consent during the interview, were selected from the elders-subsets of the Korean National Survey of Oral Health Status (KNSOHS). The maximum target sample (sample C) for the test-retest reliability was estimated at 1000 adults aged 56 or more. The subjects without any missing data were included in the analysis. We randomly selected 1098 subjects as sample C from the stratified 200 census tracts obtained by the National Population Census of Korea, which included the three strata of metropolitan city, provincial city and rural area. Sample A contained 155 subjects aged 57 or more, randomly selected from sample C. Sample B of 128 subjects aged 54 or more, living in Yeonchun-Gun, a rural community, was selected for convenience without any pressure, as these subjects were participants of the Oral Health Promotion Program for Adults or the Free Denture Program for Underserved Edentulous Adults; this sample was used for the evaluation of validity. Sample C was used for the application study of OHIP-K. The characteristics of the subjects are presented in Table 1.

Translation

A Korean dentist who is fluent in both Korean and English performed a forward translation. This translation was evaluated and revised by four other Korean dentists. A Korean scholar majoring in English language and literature reviewed this version. The translated Korean version of OHIP was then translated back into English by a Korean US resident majoring in English language and literature. The backward translated English version was nearly the same as the original English version. The elderly Korean subjects understood almost all questions from the English version except Q22 regarding 'uncomfortable appearance'. The term 'uncomfortable' was modified to 'unsatisfied'. The final Korean version was pilot-tested on 10 adults, and then reviewed and confirmed by five Korean dentists.

Data collection, scoring and prevalence: data was collected by telephone interview. To reduce any errors during the survey, we selected 15 experienced telephone interviewers and advised them of the common problems encountered from the preliminary survey. A questionnaire and letter explaining the survey was mailed to all the subjects and the telephone interviews were conducted 2 weeks later.

Responses to the OHIP questions were made on a Likert scale, which indicated if the problem had been experienced 'very often' (code = 4), 'fairly often' (code = 3), 'occasionally' (code = 2), 'hardly ever' (code = 1) or 'never' (code = 0) during the last 12 months. The OHIP-49 and the OHIP subscale scores were calculated by summing up the scores of the responses to the 49 items and the items corresponding to the subscales, respectively. Total scores of OHIP ranged from 0 to 196.

Table 1. Sample populations by type of investigation, sample type, age, gender and denture status

			Age			
Type of investigation	Sample type	*n*	Mean (SD)	Range	% Women	% Denture
Test-retest reliability[a]	Random	155	66.0 (5.9)	57–83	58.1	40.6[b]
Construct validity	Convenience	128	65.2 (7.2)	54–84	50.8	16.4[c]
Distribution and internal consistency[a]	Random	1098	67.1 (6.6)	56–87	58.2	40.5[b]

[a]Selected randomly from the cohort of the Korean National Survey of Oral Health Status in 2000.
[b]Percentage of removable denture wearers.
[c]Percentage of subjects needing removable dentures.

The prevalence of a negative impact of OHIP-49 and its subscales was determined by the percentage of adults who reported a negative impact (response codes = 3 or 4) on one or more of the 49 items and subscales, respectively.

Reliability

Test-retest reliability was assessed by intraclass correlation coefficients (ICCs) of the OHIP-49 and OHIP subscales in 155 adults, who were randomly selected from sample C of 1098 adults. The interval between the first test interview and the second retest interview was 3 months. Internal consistency was measured by Cronbach's alpha in sample C.

Validity

Validity was evaluated from a sample of 128 adults (Table 1). One interviewer performed a personal interview to gather the responses of OHIP-49 and to assess the perceived dental treatment needs of the subjects. One dentist examined the subjects to determine the number of natural teeth of each subject. The difference in the OHIP-49 and/or subscale scores between groups by the perceived dental treatment needs was tested by a Student's *t*-test. The relationships between OHIP-49 and/or subscale scores and a subject's number of natural teeth were determined by Pearson's correlation coefficients.

Application

The final version of OHIP-K was applied in sample C of 1098 adults to evaluate OHIP scores for Korean adults.

Development of OHIP-14K

To develop OHIP-14K, items that applied only to denture wearers such as Q9, 18 and 30 were first eliminated. Stepwise multiple regression analysis was applied to select two items from each subscale (18). The two items resulted in the greatest R^2 for each subscale. OHIP-14K contained two items from each of the seven subscales, for a total of 14 items. The validity and reliability of OHIP-14K and OHIP-14S were obtained in the same manner as described above for the full version of OHIP-K. The outputs of OHIP-14K were compared with OHIP-14S. The differences in the mean score and prevalence of negative impact between OHIP-14K and OHIP-14S were tested by a paired *t*-test and McNemar test, respectively.

Results

The Cronbach's alpha of OHIP-K had a range of 0.82–0.90 for the seven subscales and was 0.97 for OHIP-49. The ICCs for the seven subscales ranged from 0.40 to 0.61 and was 0.64 for OHIP-49 (Table 2).

The subjects with perceived dental treatment needs had two times higher mean OHIP-49 and subscales scores than the subjects without them (Table 3). The subjects' number of natural teeth was negatively associated with their OHIP scores (Pearson $r = -0.44$, $P < 0.001$) (Table 4). As shown in Tables 3 and 4, four subscale scores (functional limitation, psychological discomfort, physical disability and handicap) were also negatively associated with the subjects' number of natural teeth and perceived treatment needs, while two subscale scores (physical pain and social disability) were not; psychological disability was associated with perceived treatment needs, but not with the subjects' number of natural teeth.

The highest subscale score was 'functional limitation' (11.9), followed by 'physical pain' (10.4). The subscale scores ranged from 2.2 to 11.9, and the mean OHIP-49 score was 46.1. Prevalence of a negative impact of one or more items in each

Table 2. Internal consistency (Cronbach's α) and test-retest reliability (ICC) of the individual subscales and OHIP-49

Instrument (score range) Subscales (score range)	Cronbach's α (n = 1098)	Intra-class correlation coefficient (n = 155)
OHIP-49[a] (0–196)	0.97	0.64
Functional limitation[a] (0–36)	0.82	0.59
Physical pain[a] (0–36)	0.84	0.49
Psychological discomfort (0–20)	0.87	0.58
Physical disability[a] (0–36)	0.88	0.61
Psychological disability (0–24)	0.90	0.49
Social disability (0–20)	0.87	0.40
Handicap (0–24)	0.89	0.56

[a]The responses for those respondents who were not required to answer Q9, Q18 and Q30 were coded 0.

Table 3. Mean scores of OHIP-49 and subscales by subjects' perceived dental treatment needs

Instrument (score range) Subscales (score range)	Perceived dental treatment need		
	Yes (n = 68)	No (n = 60)	P-value
OHIP-49[a] (0–196)	61.81	33.63	<0.001
Functional limitation[a] (0–36)	15.29	10.08	<0.001
Physical pain[a] (0–36)	11.69	9.10	0.011
Psychological discomfort (0–20)	8.16	2.95	<0.001
Physical disability[a] (0–36)	10.97	4.23	<0.001
Psychological disability (0–24)	6.01	2.60	<0.001
Social disability (0–20)	3.44	1.78	0.008
Handicap (0–24)	6.24	2.72	<0.001

[a]The responses for those respondents who were not required to answer Q9, Q18 and Q30 were coded 0.

Table 4. Pearson's correlation coefficients between OHIP-49, subscale scores and number of natural teeth

Instrument (score range) Subscales (score range)	Number of natural teeth	P-value
OHIP-49[a] (0–196)	−0.441	<0.001
Functional limitation[a] (0–36)	−0.552	<0.001
Physical pain[a] (0–36)	−0.025	0.806
Psychological discomfort (0–20)	−0.543	<0.001
Physical disability[a] (0–36)	−0.573	<0.001
Psychological disability (0–24)	−0.185	0.070
Social disability (0–20)	−0.116	0.260
Handicap (0–24)	−0.245	0.016

[a]The responses for those respondents who were not required to answer Q9, Q18 and Q30 were coded 0.

subscale ranged from 9.2% (social disability) to 69.2% (functional limitation) and the prevalence of OHIP-49, OHIP-14K and OHIP-14S was 77.0%, 53.1% and 48.5%, respectively (Table 5). The most common item that led to a negative impact was 'food catching' (49.2%), followed by 'difficulty in chewing' (33.4%) and 'sensitive teeth' (25.8%). The prevalence of the negative impact for psychological disability, social disability and handicap were less than 10%, except for 'financial loss' (13.5%).

Of a total of 14 items, the following seven items were on both OHIP-14K and OHIP-14S: 'trouble pronouncing words', 'uncomfortable to eat', 'tense', 'diet unsatisfactory', 'interrupt meals', 'difficult to relax' and 'difficulty doing jobs' (Table 5). OHIP-14K showed nearly the same reliability as OHIP-14S: Cronbach's alpha was 0.93 and 0.92 and ICC was 0.63 and 0.65 for OHIP-14K and OHIP-14S, respectively (Table 6). Both the OHIP-14K and OHIP-14S scores were negatively associated with the subject's number of natural teeth. Adults with perceived dental treatment needs had higher mean OHIP-14K and OHIP-14S scores than adults without them. OHIP-14K correlated with OHIP-K almost exactly (r^2 = 0.96), as did OHIP-14S (r^2 = 0.95). When comparing the mean scores between OHIP-14K (12.6 ± 10.4) and OHIP-14S (12.5 ± 11.1) among sample C, it was demonstrated that there was no statistical difference between the two (P = 0.839). The prevalence of a negative impact by OHIP-14K (53.1%) was higher than that by OHIP-14S (48.5%) among sample C (P < 0.001).

Discussion

Issues concerning cross-cultural adaptation of self-reported instruments have been studied by many researchers (6, 21, 22). It is important that an adopted instrument is culturally relevant and valid for the local population while also demonstrating acceptable psychometric properties. A rigorous translation and validation process should be carried out before an instrument developed in one culture can be effectively adopted by another culture. Therefore, this type of validation study is necessary for OHIP to be used by Koreans and for comparisons of OHRQoL between countries. Although we did the forward and backward translation of the questionnaire and preliminary study in order to demonstrate cultural relevance, we did not consider *de novo* development. The final translation result could not be compared with the *de novo* development of OHIP-items. It was a weakness of our demonstrating method for cultural relevance.

When developing OHIP, the weighted OHIP score was used. However, Allen and Locker (23) reported that an unweighted score was as effective as a weighted score in both the long- and short-form of OHIP. Hence, unweighted OHIP-49 and subscale scores were used in the present study. For the prevalence of a negative impact of OHIP, the

Table 5. Prevalence of negative impact and mean score of OHIP-K among Korean elders ($n = 1098$)

Conceptual domains and questions (score range)	%	Mean score (SD)
OHIP-49 (0–196)	77.0	46.1 (36.6)
Functional limitation (0–36)	69.2	11.9 (7.6)
Q1. Difficulty chewing	33.4	1.9 (1.4)
Q2. Trouble pronouncing words[ab]	14.3	1.0 (1.2)
Q3. Noticed tooth that doesn't look right	13.3	1.0 (1.2)
Q4. Appearance affected	11.8	0.9 (1.2)
Q5. Breath stale	17.0	1.3 (1.3)
Q6. Taste worse[b]	23.9	1.4 (1.4)
Q7. Food catching	49.2	2.3 (1.4)
Q8. Digestion worse[a]	10.0	0.8 (1.1)
Q9. Dentures not fitting[c]	21.1	1.3 (1.4)
Physical pain (0–36)	49.4	10.4 (7.3)
Q10. Painful aching[b]	10.1	1.0 (1.1)
Q11. Sore jaw	4.3	0.5 (0.9)
Q12. Headaches[a]	6.7	0.7 (1.0)
Q13. Sensitive teeth	25.8	1.7 (1.4)
Q14. Toothache	15.8	1.3 (1.3)
Q15. Painful gums	15.9	1.4 (1.2)
Q16. Uncomfortable to eat[ab]	23.3	1.5 (1.4)
Q17. Sore spot	11.7	1.1 (1.2)
Q18. Discomfort (dentures)[c]	21.4	1.4 (1.4)
Psychological discomfort (0–20)	33.8	5.2 (5.1)
Q19. Worried	23.0	1.4 (1.4)
Q20. Self-conscious[b]	7.3	0.6 (1.0)
Q21. Miserable	13.9	1.0 (1.2)
Q22. Appearance unsatisfied (uncomfortable)[a]	7.9	0.7 (1.1)
Q23. Tense[ab]	22.7	1.4 (1.4)
Physical disability (0–36)	45.1	8.7 (7.9)
Q24. Speech unclear	10.7	0.8 (1.2)
Q25. Others misunderstood	5.4	0.6 (1.0)
Q26. Less flavor in food	23.4	1.4 (1.4)
Q27. Unable to brush teeth	6.5	0.8 (1.0)
Q28. Avoid eating	27.8	1.6 (1.4)
Q29. Diet unsatisfactory[ab]	17.4	1.2 (1.3)
Q30. Unable to eat (dentures)[c]	17.4	1.3 (1.3)
Q31. Avoid smiling	7.4	0.6 (1.1)
Q32. Interrupts meals[ab]	4.7	0.6 (1.0)
Psychological disability (0–24)	17.0	4.2 (5.2)
Q33. Sleep interrupted	5.5	0.6 (1.0)
Q34. Upset	6.7	0.7 (1.0)
Q35. Difficult to relax[ab]	6.0	0.7 (1.0)
Q36. Depressed[a]	7.4	0.8 (1.1)
Q37. Concentration affected	4.4	0.6 (0.9)
Q38. Been embarrassed[b]	5.5	0.6 (1.0)
Social Disability (0–20)	9.2	2.2 (3.4)
Q39. Avoid going out[a]	3.6	0.4 (0.8)
Q40. Less tolerant to family members	2.7	0.4 (0.8)
Q41. Trouble getting on with others	3.9	0.4 (0.9)
Q42. Irritable with others[b]	1.2	0.3 (0.6)
Q43. Difficulty doing jobs[ab]	3.1	0.4 (0.8)
Handicap (0–24)	21.9	4.1 (5.2)
Q44. Health worsened	6.9	0.7 (1.0)
Q45. Financial loss[a]	13.5	1.0 (1.3)
Q46. Unable to enjoy people's company[a]	6.2	0.6 (1.0)
Q47. Life unsatisfying[b]	6.9	0.7 (1.1)
Q48. Unable to function[b]	3.9	0.4 (0.9)
Q49. Unable to work	3.1	0.4 (0.8)

Score of each item ranged from 0 to 4.
Q22: The Korean version used 'unsatisfied'; Slade's version used 'uncomfortable'.
[a]Items selected for the short-form OHIP-K.
[b]Items of short-form OHIP developed by Slade (24).
[c]The responses for those respondents who were not required to answer Q9, Q18 and Q30 were coded 0.

responses were dichotomized by the cut-off point of 'fairly often' (code = 3), as suggested by Locker and Slade (2).

The values of OHIP-K Cronbach's alpha had a range of 0.82 to 0.90 for the seven subscales, which is higher than the values obtained from the German version (0.74–0.88) (10), the Chinese version (0.69–0.84) (11) and the English version (0.37–0.83) (4). The ICCs of the test-retest reliability for the seven subscales in the Korean version (0.40–0.61) were lower than those in the German version (0.63–0.92) and the Chinese version (0.72–0.92), but close to those in the original English version (0.08–0.77). We speculated that the low ICCs of the Korean version were due to the longer interval between test and retest: 3 months in the Korean and the original English version, compared with 1 week in the Chinese version and 2 weeks in the German version. The OHIP-49 and subscale scores were strongly associated with the subject's perceived dental treatment needs and the number of the subject's natural teeth. All of these results suggest that OHIP is reliable and valid for evaluating OHRQoL for Korean adults. Importantly, the validation study administered OHIP by personal interview, whereas other aspects of this study were constructed by telephone interview. The results of OHIP were not related to the methods of administration (1, 24). Two different administrative methods could not alter the interpretation of the findings in this study. Although the reliability of an index decreases as the number of items in a questionnaire decreases, a short-form OHIP was developed to make the investigation of OHRQoL simpler and less time consuming (18). We developed OHIP-14K for the same reason. For this development, we adopted the same method that was used to derive OHIP-14S. OHIP-14K could account for 96% of OHIP-K. The Cronbach's alpha

Table 6. Reliability and validity of OHIP-14K and OHIP-14S

	OHIP-14K (0–56)	OHIP-14S (0–56)
Reliability		
Intraclass correlation coefficient ($n = 155$)	0.63	0.65
Cronbach's α ($n = 1098$)	0.93	0.92
Validity		
R^2-value[a] ($n = 1098$)	0.96	0.95
Number of natural teeth (r)[a] ($n = 128$)	−0.505 ($P < 0.001$)	−0.428 ($P < 0.001$)
Perceived dental treatment need ($n = 128$)		
Yes	17.0	16.7
No	7.6	7.9
	$P < 0.001$	$P < 0.001$

[a]Obtained from the regression model with mean OHIP-14 score of independent variable and mean OHIP-49 score of dependent variable.
[b]Correlation between OHIP score and subject's number of natural teeth.

value of OHIP-14K was as high as that of OHIP (0.93 versus 0.97). The ICCs of both OHIP-K and OHIP-14K were nearly the same (0.63 versus 0.64). Moreover, the OHIP-14K score was strongly associated with the subject's number of natural teeth and the subject's perceived dental treatment needs. According to these results, OHIP-14K is as valid and reliable as OHIP-K.

Only seven selected items were identical between OHIP-14K and OHIP-14S (Table 5). It was speculated that the result was caused by the subjects' differences in culture, demographic composition, and oral health status between Slade's study and this study. Despite this, OHIP-14K and OHIP-14S demonstrated nearly the same validity and reliability. Our data showed that the mean score of OHIP-14K was similar to that of OHIP-S, but OHIP-S underestimated the prevalence of a negative impact. As the short-form of the OHIP was developed using linear regression models with the mean score as a dependent variable, it resulted in a similar outcome for the mean scores. Therefore, more appropriate methods should be developed and used for both the mean score and prevalence of the OHIP-14. Notwithstanding, we suggest that OHIP-14S may be a better choice for the evaluation of OHRQoL for Koreans, considering the comparison with the results of other countries' studies.

Prevalence of a negative impact of OHIP in the present study (9.2–69.2%) was much higher than that of the Canadian study (1.2–43.5%) (2). The subscale scores were much higher in the present study (2.2–11.9) than in the Chinese study (0.5–8.1) (11). From this we may infer that Korean elders have inferior oral health compared with Chinese elders. Although the cutoff point of the negative impact was 'hardly ever' (code = 1) in the German study (25), prevalence of a negative impact of OHIP in the present study was higher than in the German study (13–46%).

For a comprehensive understanding of OHIP for Koreans, more studies on the relationships between OHIP and clinical oral health indicators such as dental caries, periodontal status and other oral signs and symptoms are needed among different age groups. Moreover, the relationship between OHIP and health related quality of life such as EUOQOL and SF-36 should be tested in further studies.

In conclusion, the translated Korean version of OHIP showed good reliability and validity in this study and it could be used as a valuable instrument for the investigation of OHRQoL for Koreans. Finally, OHIP-14S may be a better choice for the evaluation of OHRQoL among the Korean elderly for international comparisons.

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